# Rapid Response database for hydrological modeling

## Socioeconomic impact analysis of linking remote sensing and process-based hydrological models to improve post-fire remediation efforts.


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Project Summary: Quantify the Socioeconomic impact of our Rapid

# Introduction

- Forests provide many products as well as ecosystem services
  - Wood
  - Wildlife and fish habitat
  - Recreation
  - Clean water
- Wildfire impacts on watersheds
  - Increased peak flow rates (up to 100x)
  - Increased sediment delivery to streams (up to 1000x)

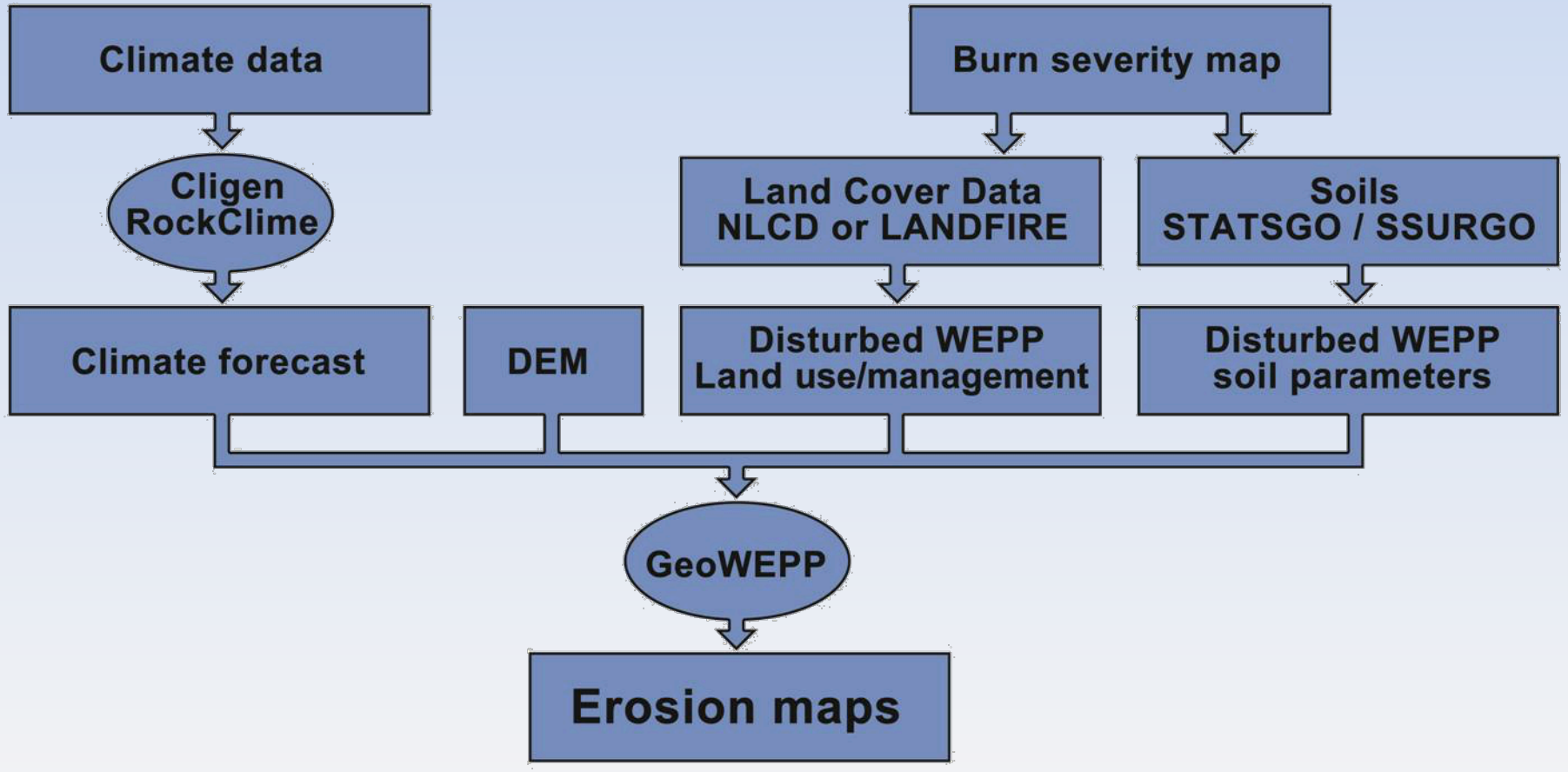
Forest in Northern Idaho

Waiting for the flood after an Arizona fire

# BAER Teams
## (Burned Area Emergency Response)

- Mission: Protect lives, property and natural resources threatened by post-fire flooding and erosion.
- BAER Teams go to work before the fire is out.
- Treatments need to be completed before a major storm in order to be effective.

# WEPP (**W**ater **E**rosion **P**rediction **P**roject) Watershed Erosion Model

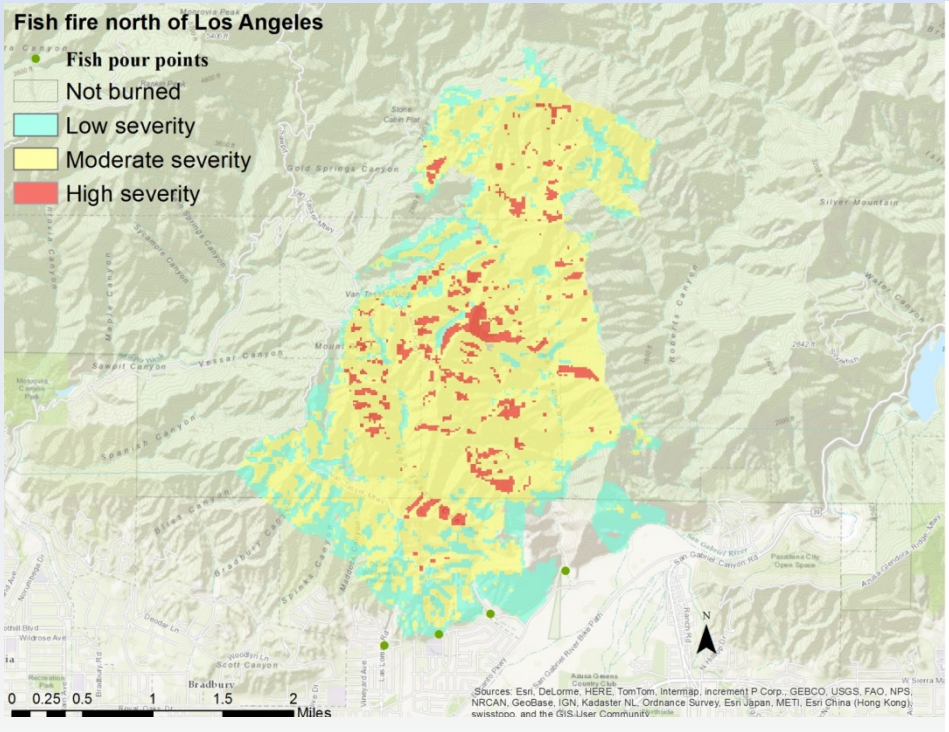


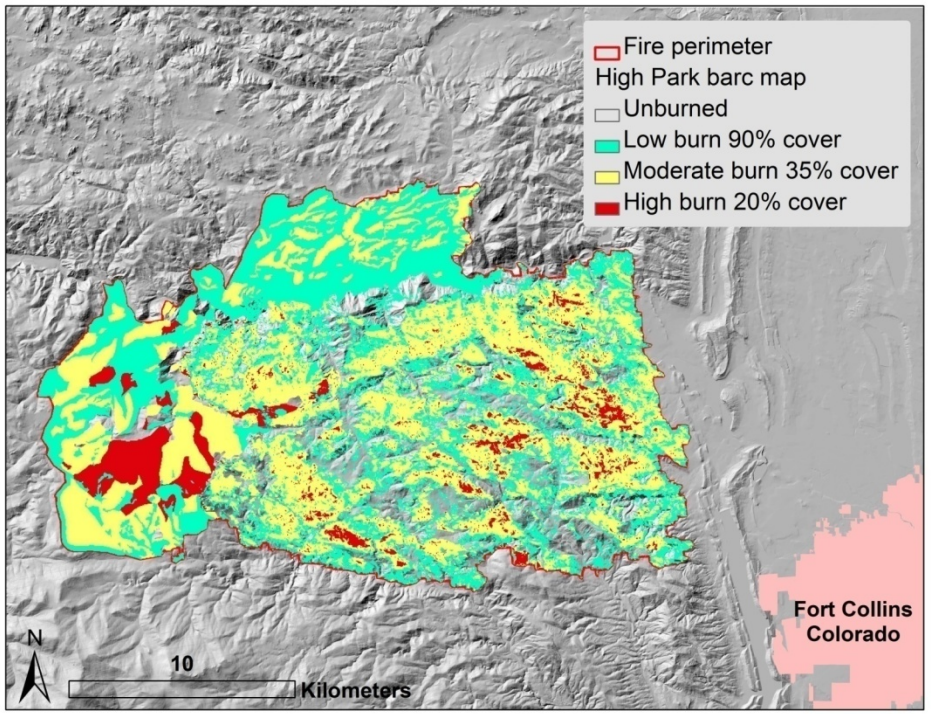
# Remote Sensing Data

$$NBR = (R_{NIR} - R_{SWIR}) / (R_{NIR} + R_{SWIR})$$

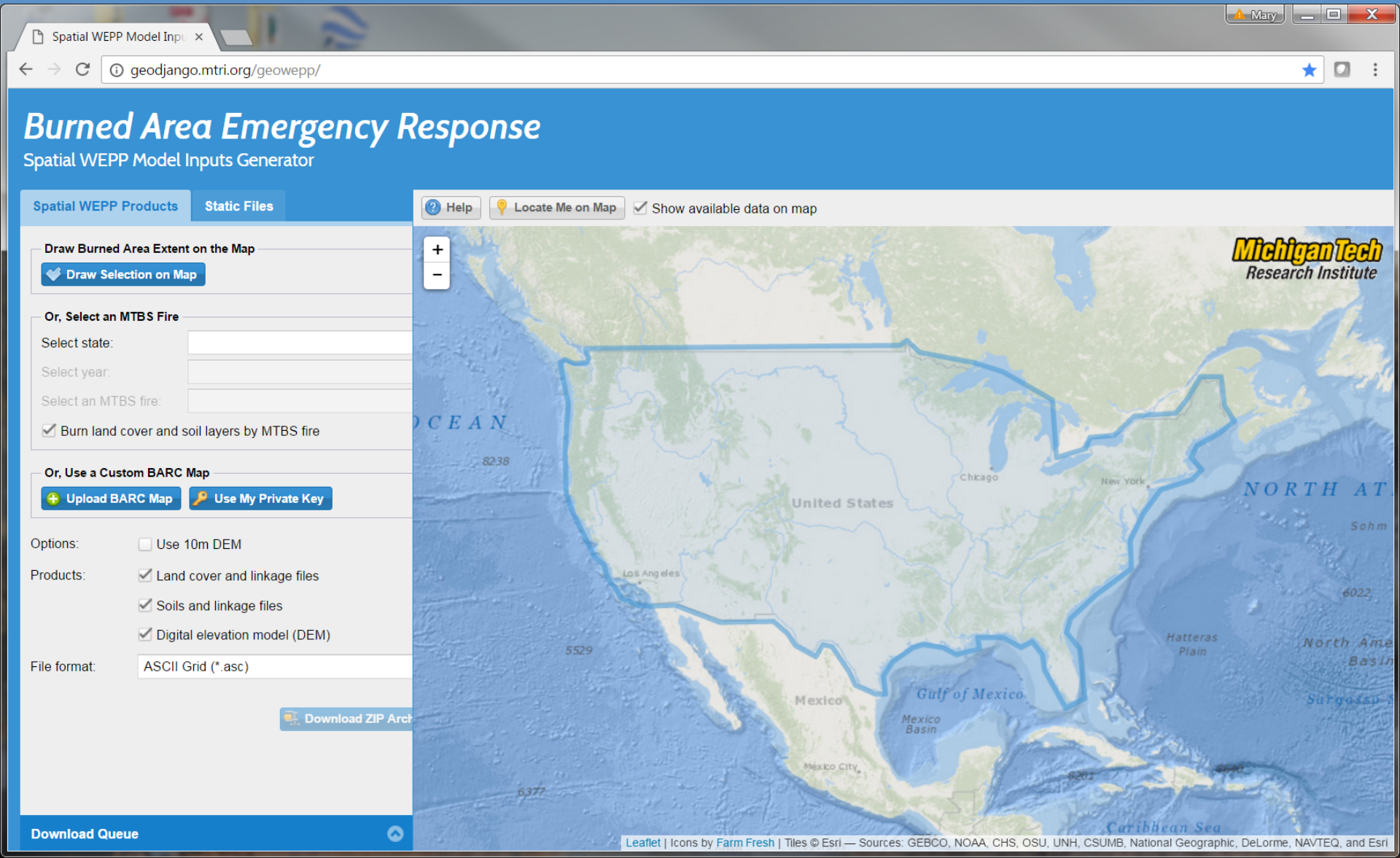
Where: R is the reflectance at the satellite in either the near-infrared (NIR) or the shortwave-infrared (SWIR). The change in NBR between the pre- and post-fire conditions is calculated by:

$$dNBR = NBR_{prefire} - NBR_{postfire}$$

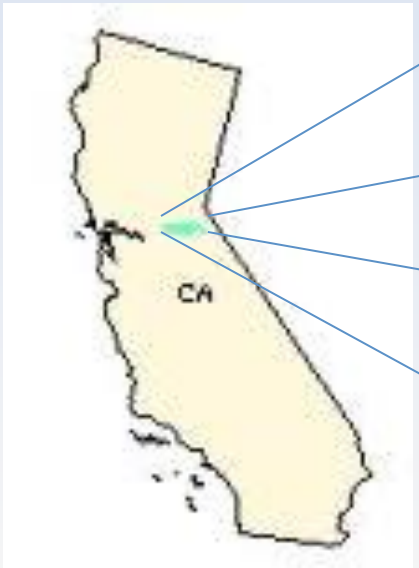



# http://geodjango.mtri.org/geowepp/



# NASA BAER RRED for fuel planning

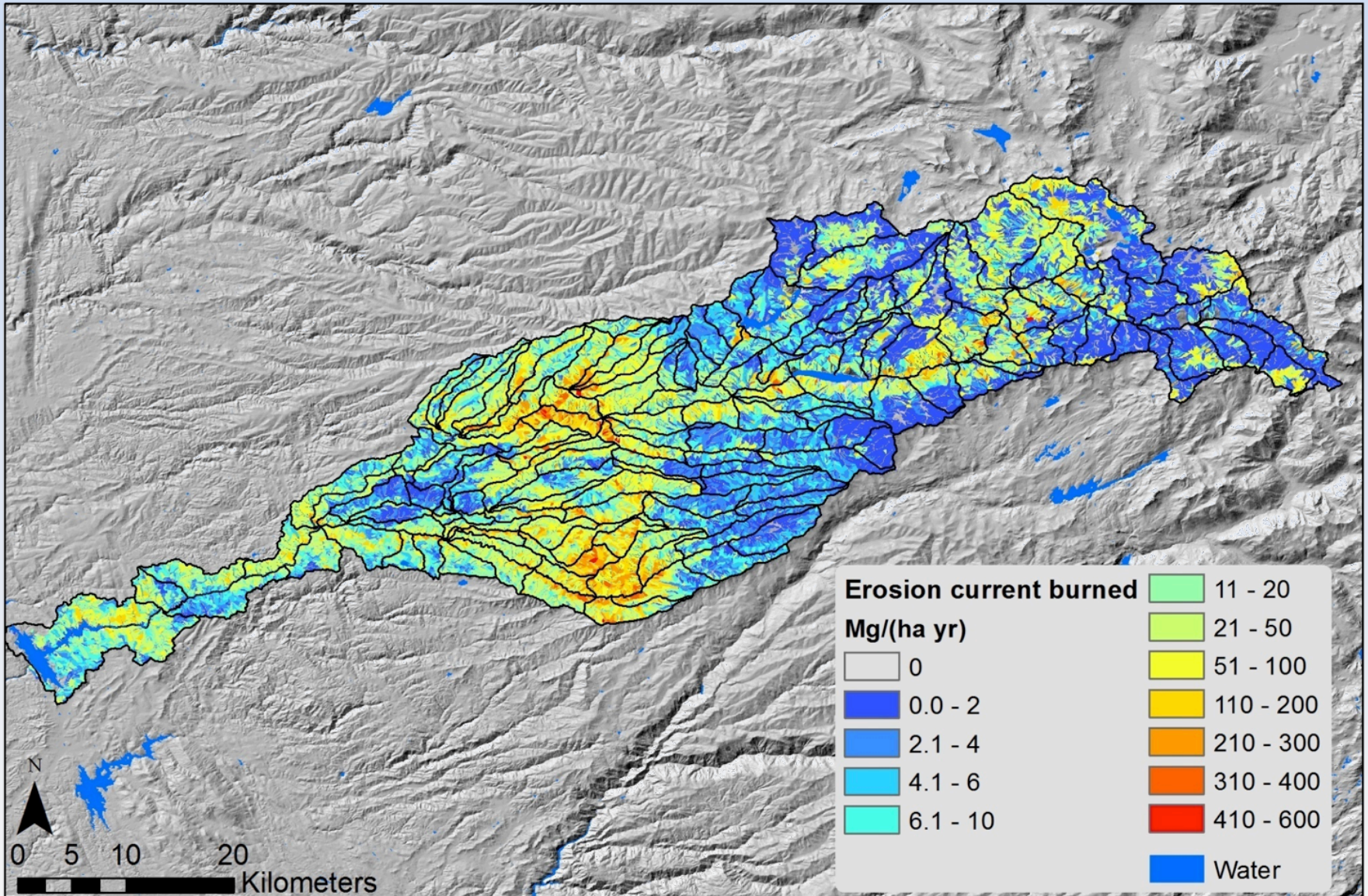
- Mokelumne Watershed in the Sierra Mountains in central California
  - 5500 $km^2$
  - Vegetation: oak savannah to evergreen forest
  - 800-1430 m elev.



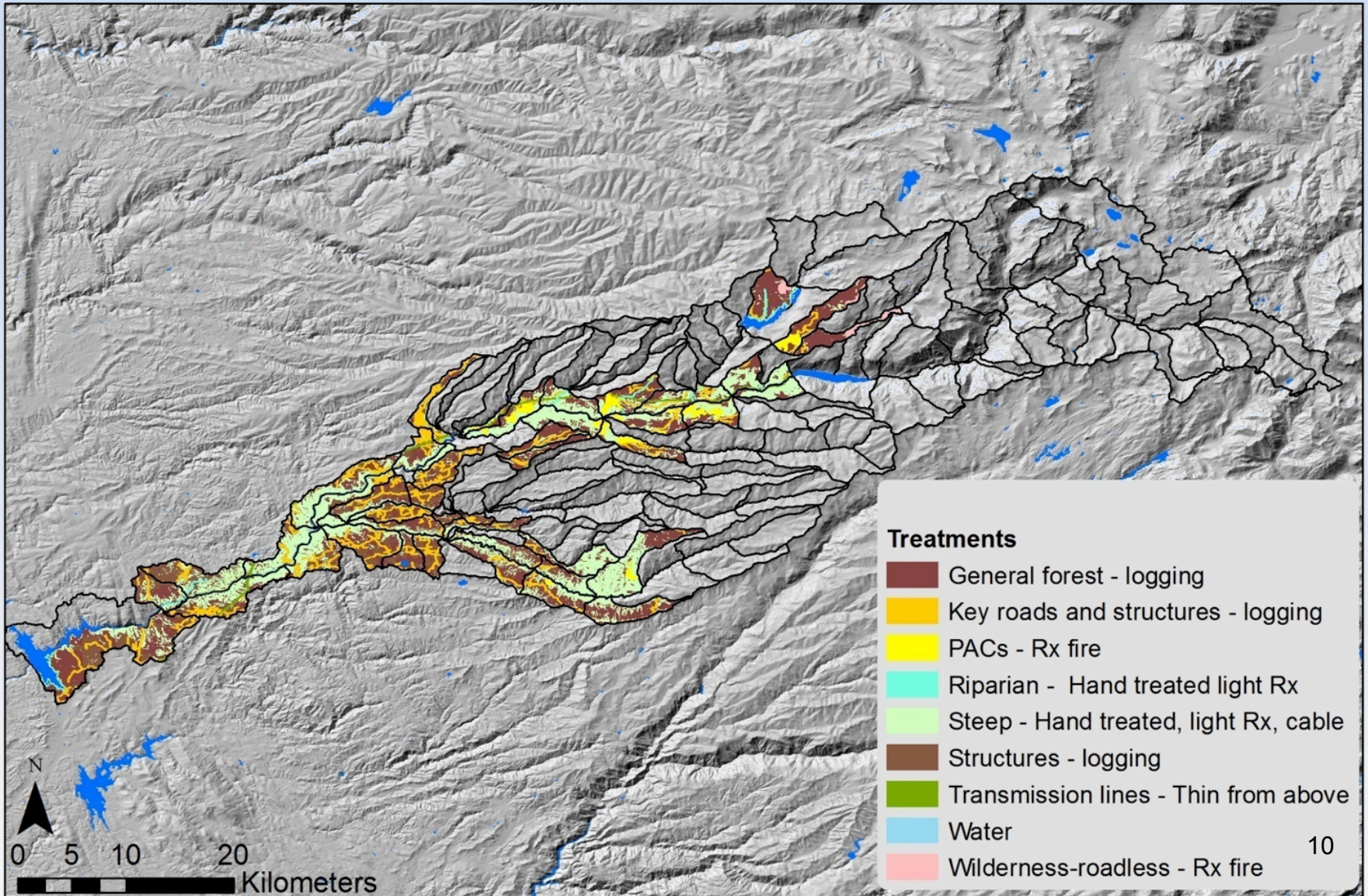

# Approach

- Determine hillslope-scale sediment production for:
  - Current conditions in the absence of fire;
  - After a fire assuming current fuel conditions;
  - After fuel treatments;
  - After a fire following treatments;
- Need to use two models:
  - **FLAMMAP** to predict fire severity and probability
  - **WEPP Watershed** to predict erosion

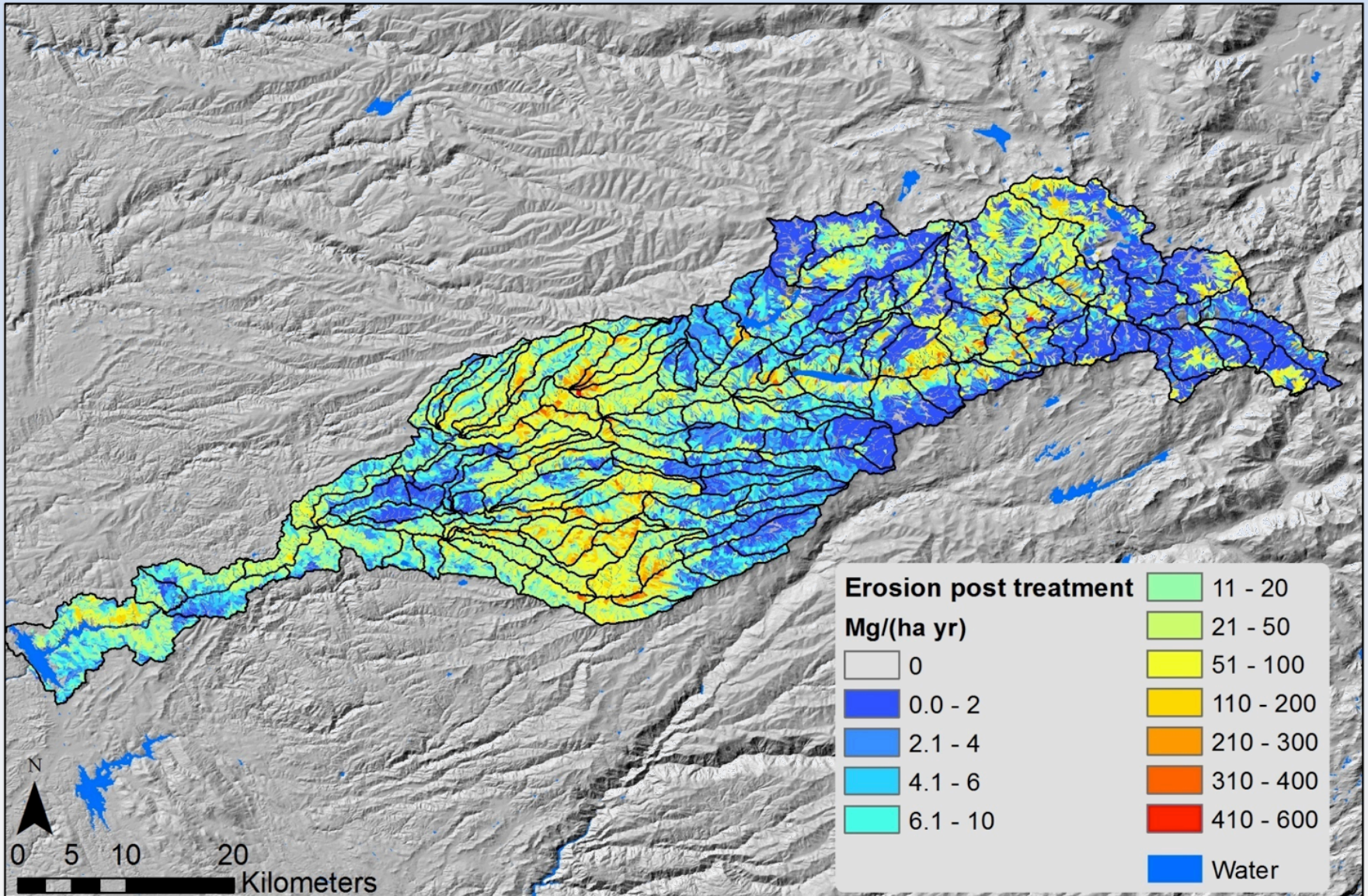
# Results: Hillslope scale first year post-fire erosion predictions current conditions



# Treatment Maps

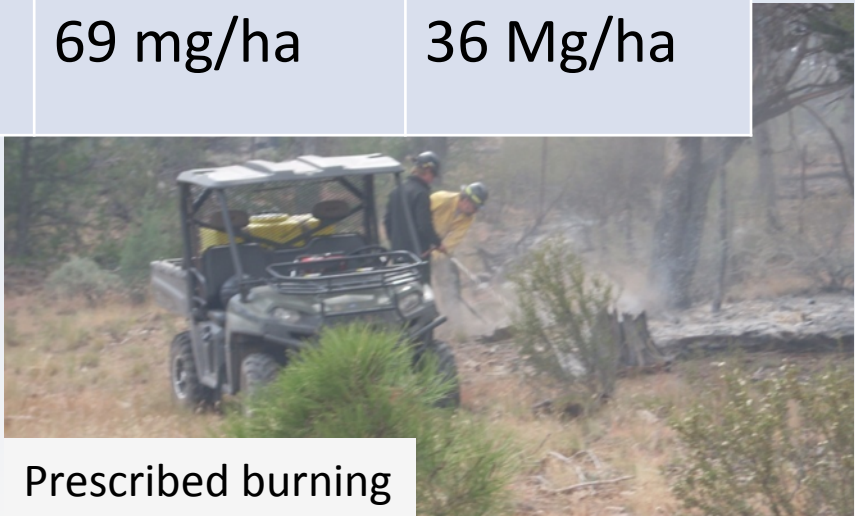


# Results: Hillslope scale first year post-fire erosion predictions post treatment



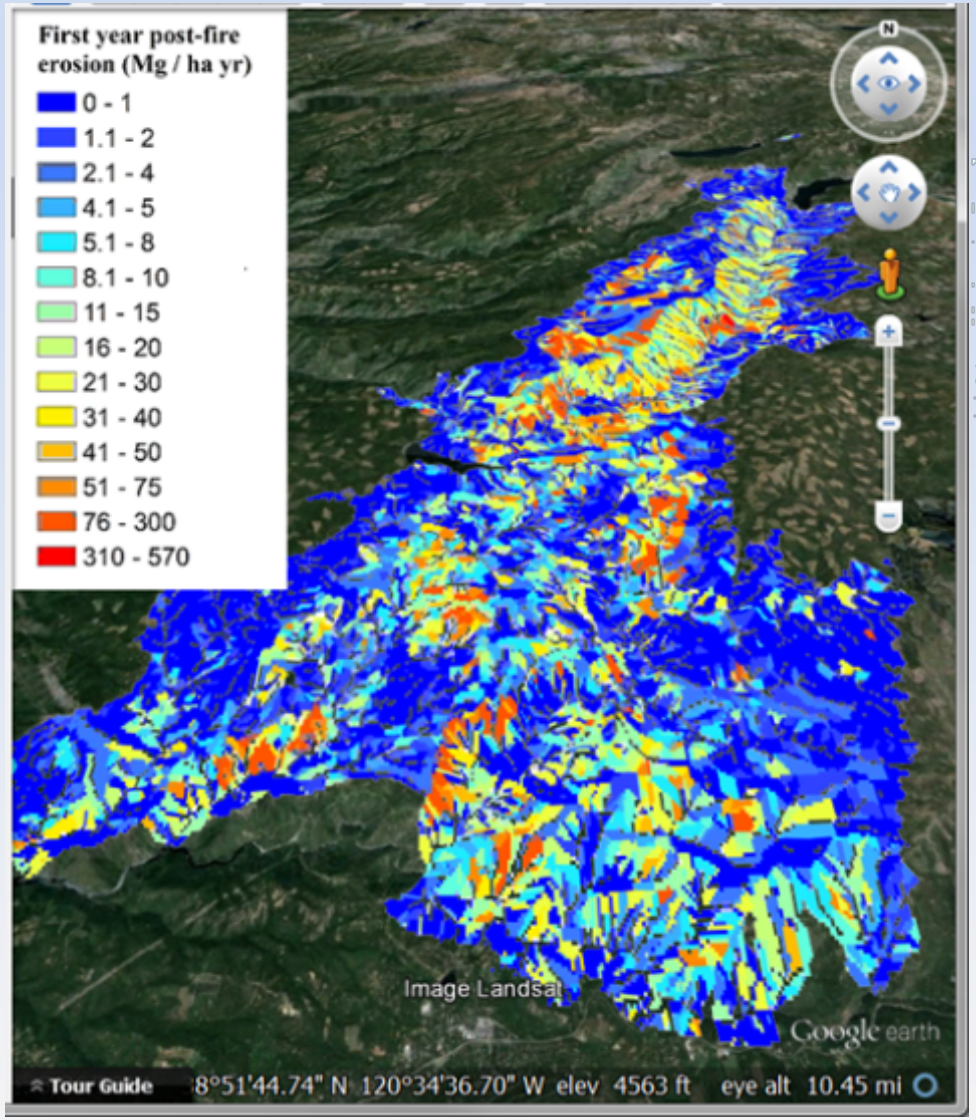
# Summary of Results for Treatment Area

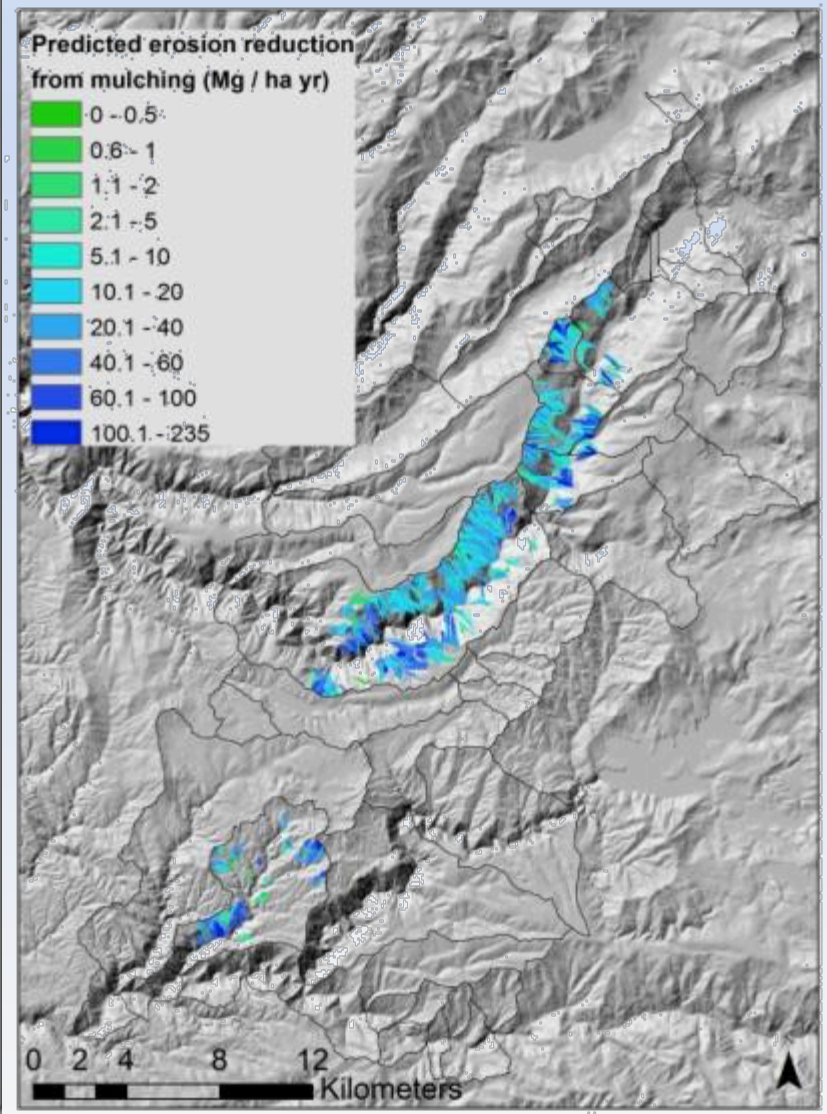
| | Current Condition | Treatment Effects | Fire Following Current Condition | Fire Following Treatment |
|---|---|---|---|---|
| Average Erosion in Basin | 4.7 Mg/ha | 7.6 Mg/ha | 46 Mg/ha in year 1 | 26Mg/ha in year 1 |
| Range | 0 – 442 Mg/ha | 0 – 71 Mg/ ha | 0 – 566 Mg/ ha | 0 – 535 Mg/ha |
| Standard Dev | 15 Mg/ha | 9 Mg/ha | 69 mg/ha | 36 Mg/ha |



Prescribed burning

# Socioeconomic Impact
# King Fire (395 km$^2$ )



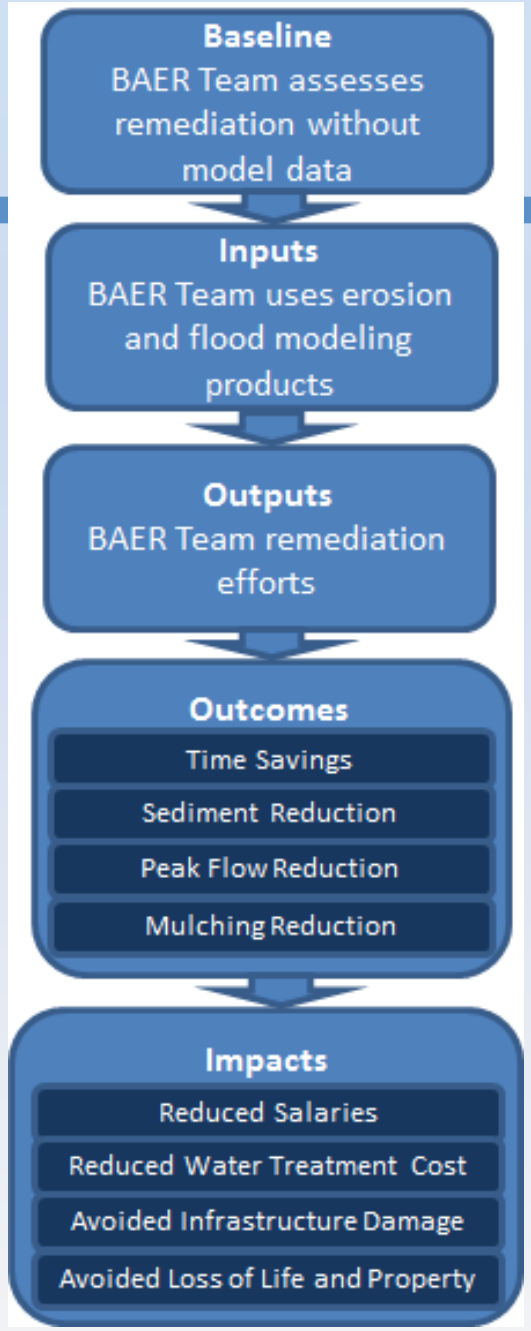
# Socioeconomic Impact Butte Fire (287 $km^2$)

- Butte fire in California the BLM spent more than $3 million on mitigation treatments, justified and targeted using modeling products made possible by our NASA BAER program (William Haigh, BLM, Personal communication, 6 January 2016).

Photo provided by: Bill Haigh

# Socioeconomic Tool Selection

We selected the retrospective Cost-effectiveness analysis (CEA) tool to essentially preform a Cost Benefit Analysis on the use of our RRED for performing BAER work which is essentially a Cost Benefit Analysis that has to be carried out in one week!




# Objectives

1. Develop a rapid online survey from database users to collect initial use information and contact information for later use.
2. Gather and analyze data from existing BAER reports and literature to determine costs and benefits of using post-fire erosion models. ( http://forest.moscowfsl.wsu.edu/cgi-bin/BAERTOOLS/baer-db/index.pl)
3. Design and implement in depth follow on surveys to collect data from our database users.
4. Utilize the BAER Values-at-Risk Calculation tool to predict effects of both having and not having model outputs derived from parameterizing process based model with earth observations of burn severity.
5. Create an impact report and peer-reviewed paper detailing results.

# More Potential End Users

- **Watershed managers**
- **Academic / students**
- **Fuels planning from watershed perspective**
- **EPA – Total Maximum Daily Loading**
- Agriculture
- Construction

# Questions

Socioeconomic analysis of my program could potentially show BAER Teams spend more with the modeling results.

- Would you like us to try to consider time savings of potential non-fire users?
- Dr. Breffle wants to consider human life, I was not planning on this. Is this something NASA is interested in?
- Should we try to estimate the impact of NASA imagery on BAER process as a whole as well?